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OCR A Level Computer Science

H446 – Paper 2

1

The IDE and programming basics

Unit 11

Programming techniques

PG ONLINE

Objectives

- Be familiar with the use of an IDE to develop and debug a program
- Define what is meant by an algorithm and pseudocode
- Learn how and when different data types are used
- Learn the basic arithmetic operations available in a typical programming language
- Write pseudocode solutions to simple problems

Facilities of an IDE

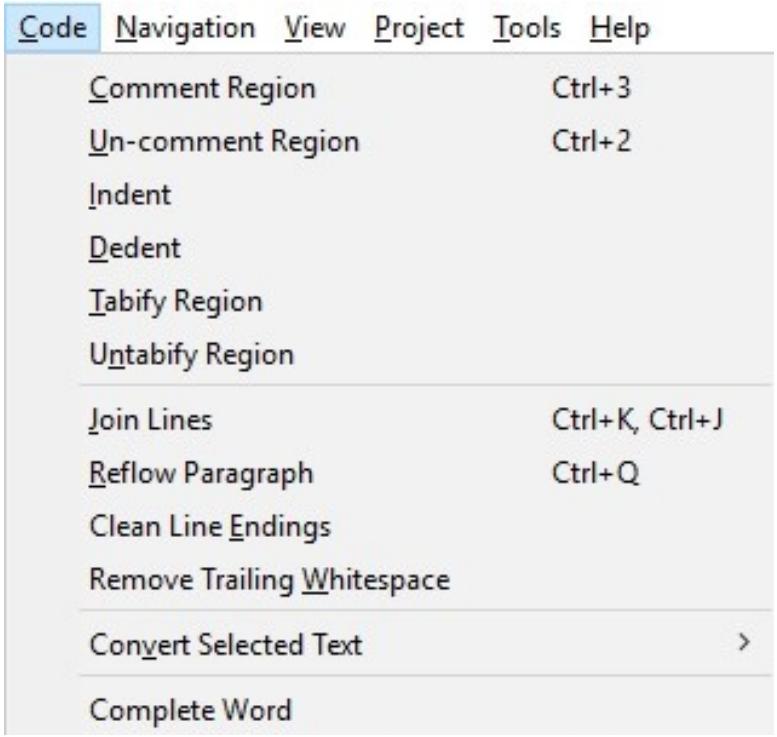
- An IDE (Integrated Development Environment) is software which enables you to enter, edit, compile (or interpret) and run your programs
- Many IDEs will also have debugging facilities to help you find the logic errors in a program
  - Why type your program in an IDE rather than a text editor?

Entering a program in an IDE

- An IDE can offer many features specifically designed to make entering program code as easy and quick as possible
  - add line numbers
  - automatically indent code
  - auto-complete commands
  - comment or un-comment a region

Typical IDE options

- Here are some of the menu options when entering program code in the IDE Komodo Edit:



Finding syntax errors

- When you interpret or compile a program, syntax errors will be reported:

```
3    a = 5
4    b = 10
5    c = 6
6    answer1 = a + b * c
7    print ("answer1 =" answer1)
8    answer2 = (a + b) * c
9    print ("answer2 =", answer2)
```

```
line 7
    print ("answer1 =" answer1)
                             ^
SyntaxError: invalid syntax
```

Finding logic errors

- Once you have corrected all the syntax errors, your program may still not run

```
3    a = 5
4    b = 10
5    c = "6"
6    answer1 = a + b * c
7    print ("answer1 =", answer1)
8    answer2 = (a + b) * c
9    print ("answer2 =", answer2)
```

```
line 6, in <module>
    answer1 = a + b * c
TypeError: unsupported operand type(s) for +: 'int' and 'str'
```

Debugging facilities

- Logic errors can be hard to find
- Many IDEs provide debugging facilities
  - Set a **breakpoint** in the program which will cause the program to stop on that line
  - Set a **watch** on a variable so that its value is displayed each time it changes
  - **Step through** a program one line at a time
  - **Trace** the execution of a program – for example display a message every time a particular statement is executed or subroutine is called

Worksheet 1

- Try **Task 1** on the worksheet

Algorithms

- An algorithm is a sequence of instructions that can be followed to solve a problem
- For example, suppose you want to calculate the amount of paint needed to paint a room

Problem: calculate paint required

- What inputs would you need?
- What decisions does the painter need to make?
- Think out the sequence of instructions, starting with

  Input the dimensions of the room

- Use statements like

  Input, Calculate, Output,
  Add, Subtract, Multiply

- Or maths symbols like +, -, * (multiply)

Worksheet 1

- Complete **Task 2** of the Worksheet

Pseudocode

- Pseudocode is used to write instructions in statements that are somewhere between English and a programming language
- There are guidelines for writing pseudocode, but no strict rules
- They are an aid to thinking out the steps needed before you start to code
- Once you have written the pseudocode, the coding should be a breeze!

Pseudocode statements

- Assignment statements are written using an = sign
- The symbols +, -, *, / , ** (exponentiation) are used for common arithmetic operations

```
miles = currentMileage – previousMileage
count = count + 1
```

- Input and output statement are written

```
currentMileage = input (“Enter current mileage”)
print (“You have travelled ”, miles, “miles”)
```

Pseudocode statements

- What do the following statements do?

1. number = input (“Enter a number”)
2. number = number + 1
3. print (“The number is : ”, number)

Pseudocode

- Compare pseudocode and Visual Basic
  - What is happening?
  - What is the advantage of using pseudocode?

```
number = 0
number = input("Enter
number")

if number > 4 then
    print("Greater than 4")
else
    print("4 or less")
endif
```

```
Dim number As Integer = 0
Console.Write("Enter number")
number = Console.ReadLine()
If number > 4 Then
   Console.WriteLine("Greater than
4")
Else
   Console.WriteLine("4 or less")
End If
```

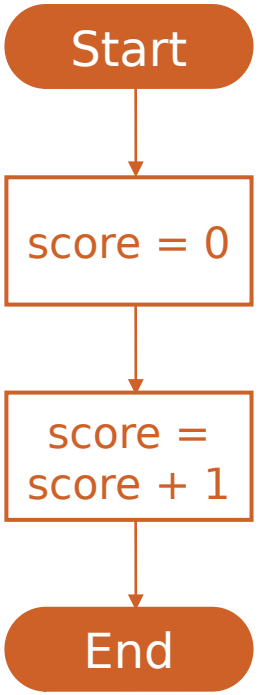
Pseudocode

- What is the purpose of pseudocode?
- What guidelines would you suggest for writing clear, understandable pseudocode?

```
number = 0
number = input ("Enter number:
")
if number > 4 then
   print ("Greater than 4")
else
   print ("4 or less")
endif
```

Variables and assignment

- An **identifier** is a name, e.g. **score**, that points to a memory location
- **Assignment** is assigning a value to the memory location
- In this example **score** is assigned the value of **0**
- In the next line, **1** is added to **score** and the result is again assigned to **score**



Data types

- Here are some variable declarations in VISUAL BASIC
  - What does each line do?

```
1.  Dim wholeNumber As Integer =
    5
2.  Dim height As Decimal = 1.5
3.  Dim name As String = "Bob"
4.  Dim choice As Char = "a"
5.  Dim validData As Boolean =
    False
```

- In Python, a variable doesn't have to be explicitly declared as a particular data type
- It happens when you assign data to the variable

Data types

- What happens if the character “9” is assigned to an integer variable?
- What are the allowable values of a Boolean data type?

```
1. Dim wholeNumber As Integer =
   5
2. Dim height As Decimal = 1.5
3. Dim name As String = "Bob"
4. Dim choice As Char = "a"
5. Dim validData As Boolean =
   False
```

Variables and Constants

- The value of a variable can be changed while the program is running
- To change the value of a constant, you have to change it in the source code and then recompile
- A constant cannot be the target of an assignment

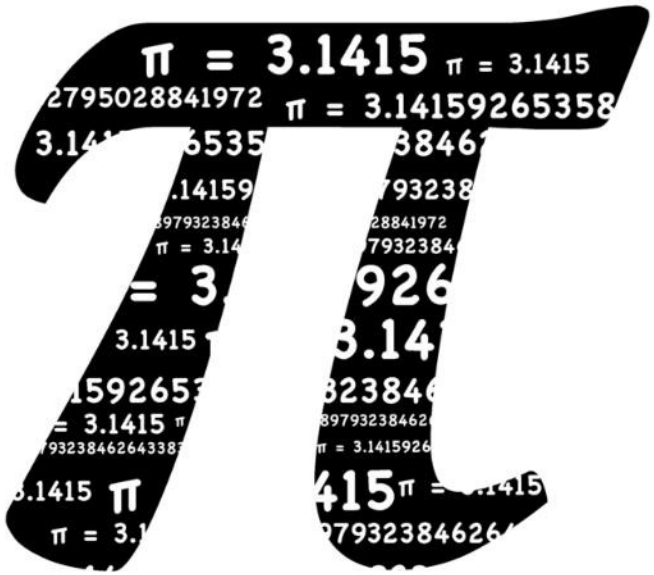
```
Dim name as String = "Robert"
Const VAT as Single = 17.5

Console.WriteLine("VAT is: " & VAT)
name = "Hazel"
Console.WriteLine("Name is: " &
name)

VAT = 20          this will cause an
error
```

Why use a constant?

- Constants reduce the risk of errors by reducing access to the memory location
  - Would you declare 3.14159265359 as a variable or a constant?



Worksheet 1

- Complete **Task 3** of the Worksheet

The mod and div operators

- The operator mod is used to find the remainder in integer division
- div returns the integer part of the division

```
x = 17 mod 3      sets x = 2
y = 17 div 3      sets y = 5
```

The mod and div operators

Calculate the following:

1. 8 mod 8
2. 8 div 8
3. 10 mod 8
4. 10 div 8

String handling functions

- Programming languages have a number of built-in string handling functions or methods
- For example:

```
name = "Robert "
x = len(name)
```

returns the length of string name

```
x = name.find("be")
```

determines if "be" occurs in string name

(returns the position of the first character in the string, 0 if not found)

String handling functions

- What would the following return? (Assume the index starts at 0)

```
name = "John"
x = len(name)
x = name.find("be")
x = name.find("oh")
```

String handling

- What values will be assigned to the variables?
  - (A string is indexed from 0)
  - What type are the variables?

```
Dim name As String = "Robert"
'Retrieves element 1 and assigns it to letter
   letter = name.Substring(1)
'Third element in the name string
   thirdChar = name(3)
'Assigns elements 1 to 3 in name to answer
   answer1 = name.Substring(1,3)
'Determines if start of string matches the search
string        answer2 = name.StartsWith("Ro")
   answer3 = name.StartsWith("Jo")
```

Worksheet 1

- Now try the questions in **Task 4** of the worksheet, and the extension task if you have time

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